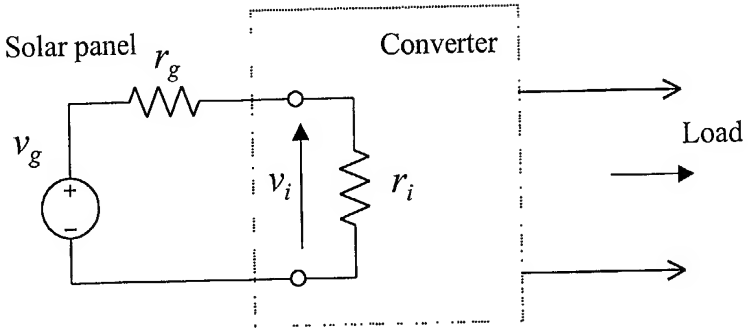


Fig. 1 Equivalent circuit of a solar panel connecting to a converter.

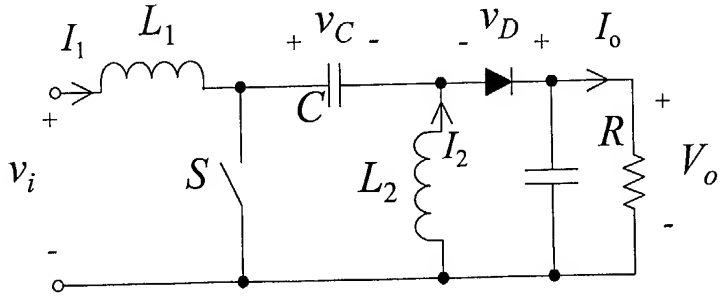
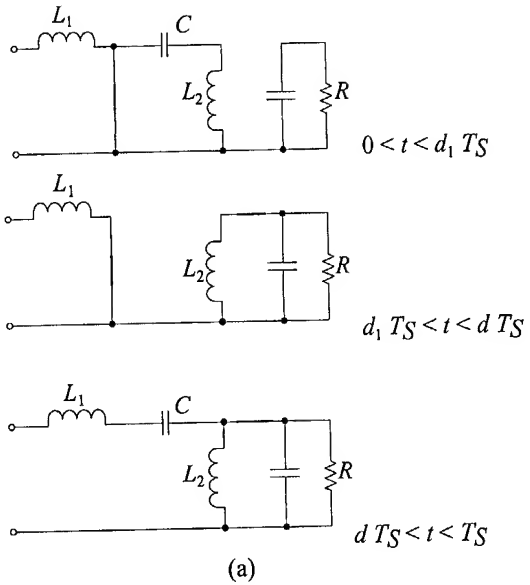
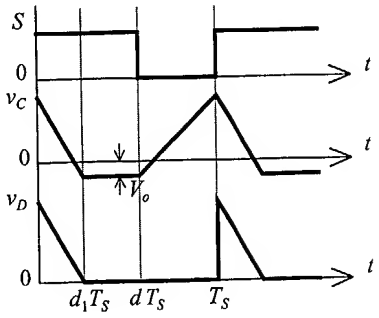


Fig. 2 SEPIC converter circuit.



(a)



(b)

Fig. 3 Operating principle. (a) Topology sequence. (b) Theoretical waveforms of v_C and v_D.

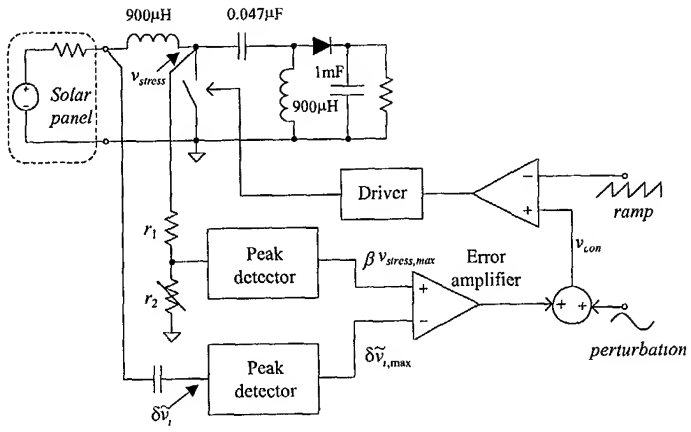


Fig. 4 Block diagram of proposed MPP tracking method.

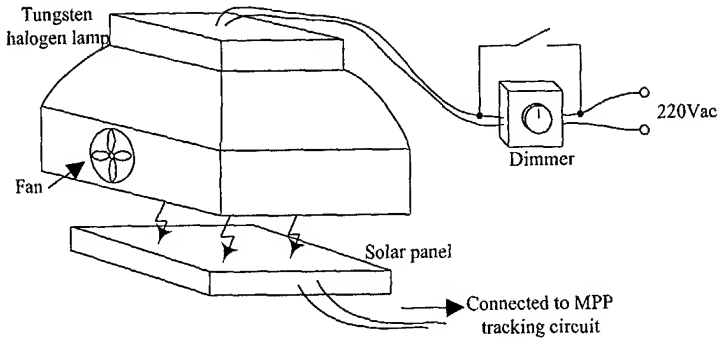
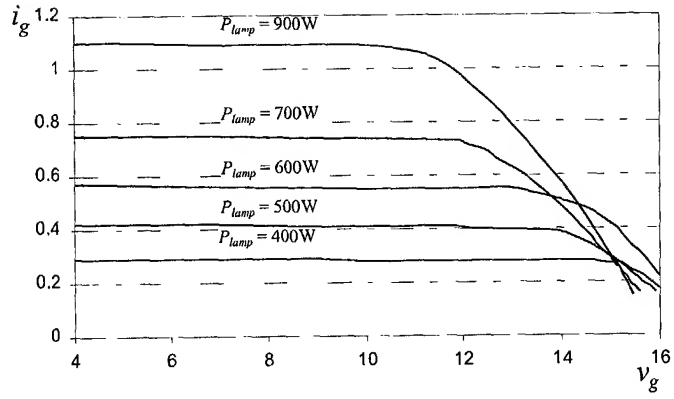
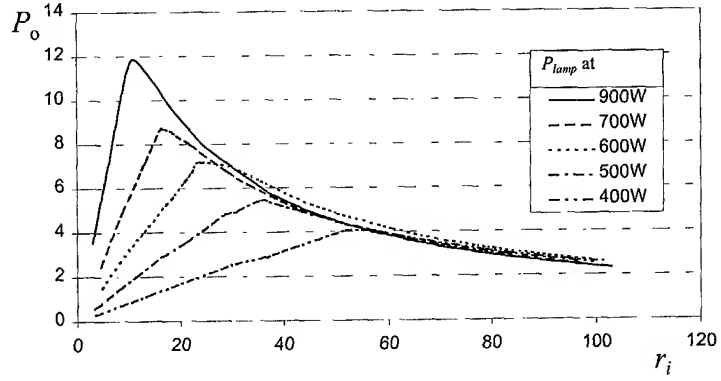


Fig. 5 Experimental setup for the solar panel.

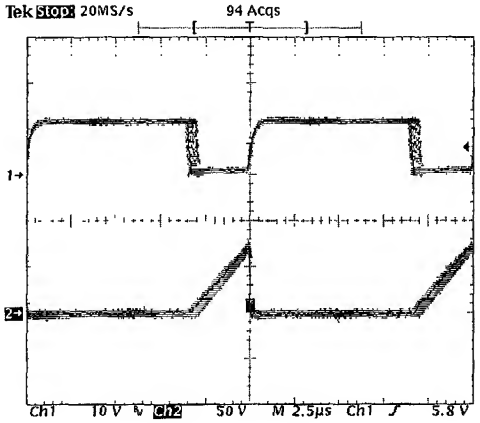


(a)

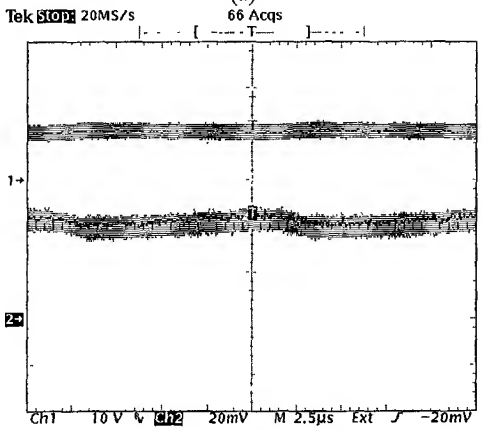


(b)

Fig. 6 Solar panel characteristics at different P_{lamp}. (a) i_g versus v_g . (b) P_o versus r_i.



(a)



(b)

Fig. 7 Detailed experimental waveforms of the SEPIC converter. (a) Ch1: gate signal, 10V/div; Ch2: switch voltage stress, 50V/div. (b) Ch1: input voltage, 10V/div; Ch2: input current, 0.5A/div.

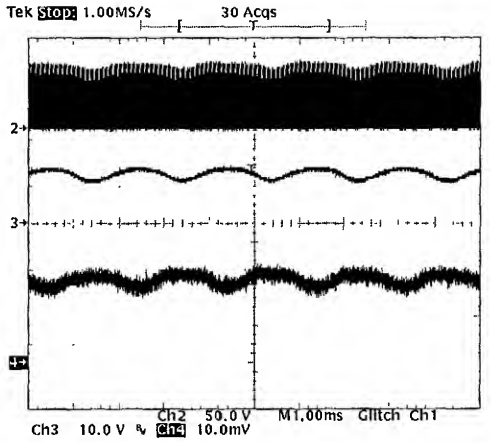
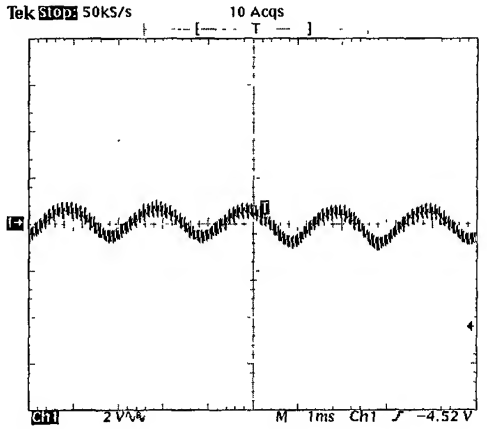
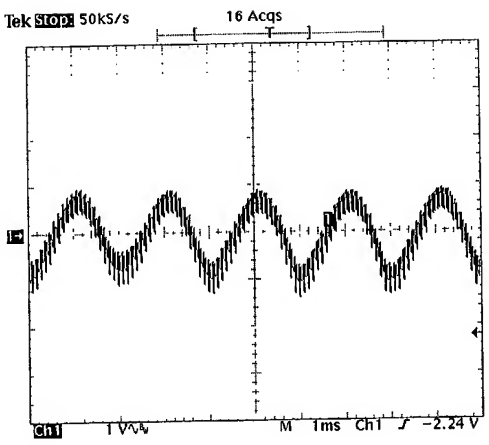


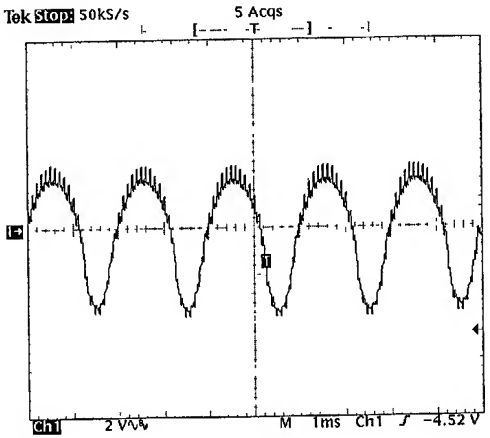
Fig. 8 Experimental waveforms of the SEPIC converter. Ch2: switch voltage stress, 50V/div; Ch3: input voltage, 10V/div; Ch4: input current, 0.5A/div.



(a)



(b)



(c)

Fig. 9 Waveform of $\delta\tilde{v}_i$ with respect to different value of $\Re$. (a) $\Re = 0.02$. (b) $\Re = 0.05$. (c) $\Re = 0.1$.

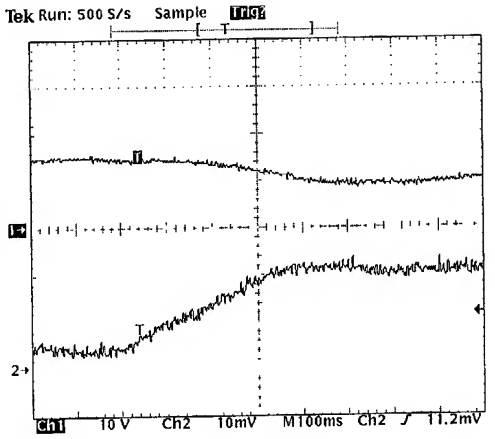


Fig. 10 Transient waveforms of the SEPIC converter subject to P_{lamp} changed from 500W to 900W. Ch1: input voltage, 10V/div. Ch2: input current, 0.5A/div.

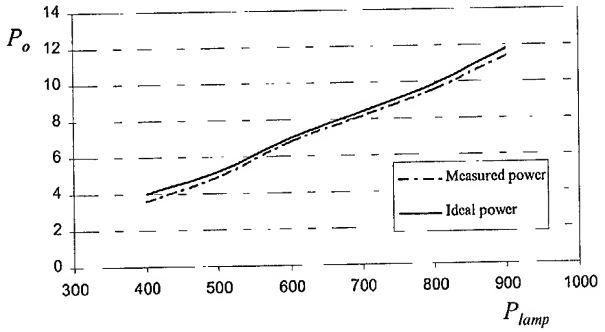


Fig. 11 Comparison of maximum solar panel output power using proposed method and the ideal ones in Fig. 6(b), under different P_{lamp}.

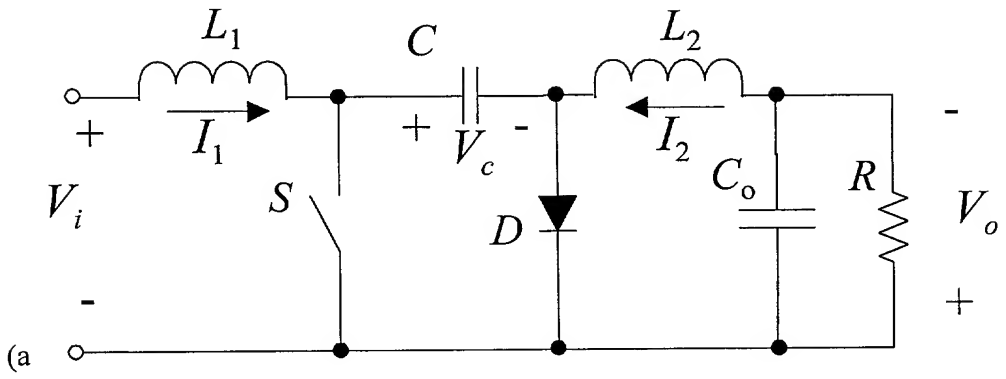


Fig. 12 Circuit diagram of the Cuk converter.

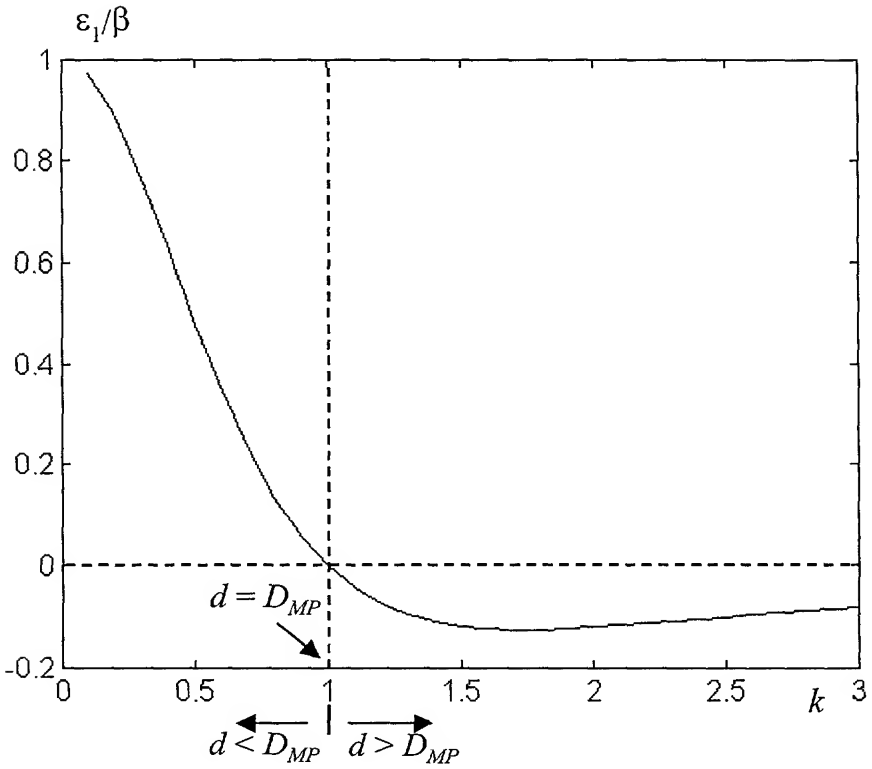


Fig. 13 Relationships between ε_1 / β and k.

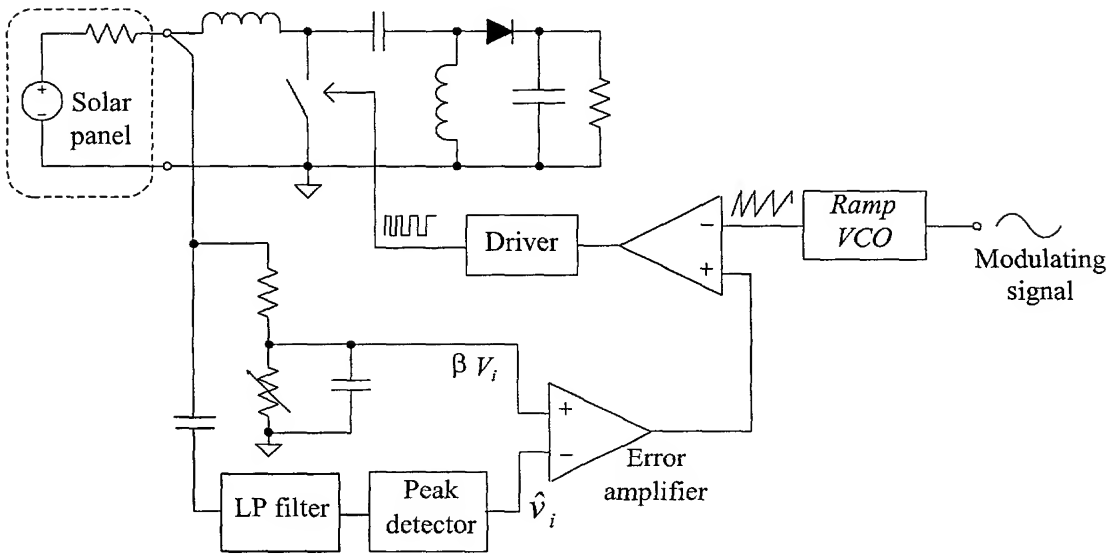


Fig. 14 The proposed MPP tracking method.

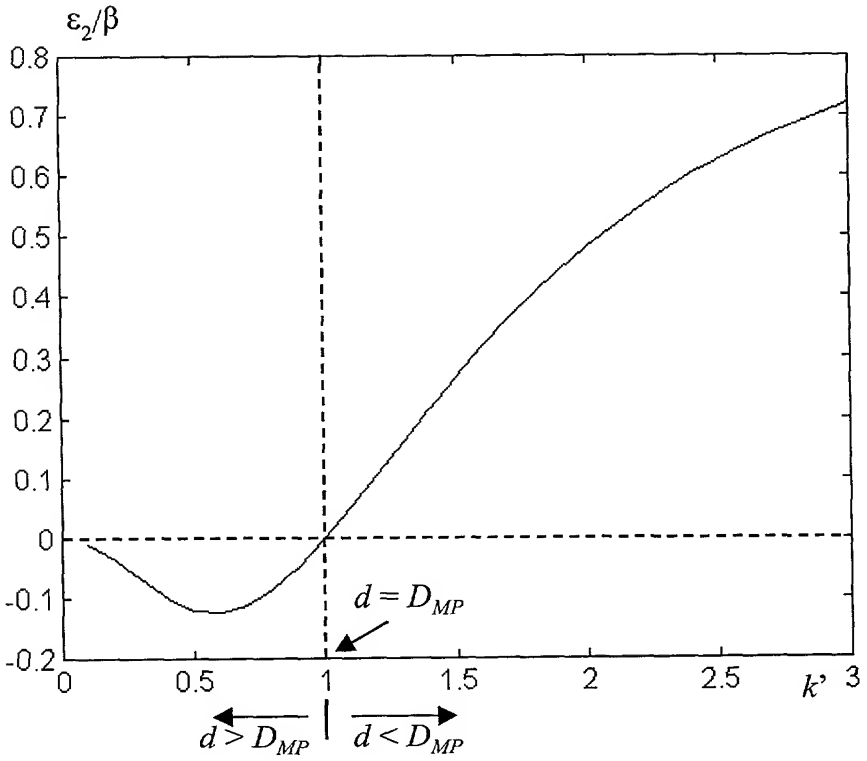


Fig. 15 Relationships between ε_2 / β and k'.

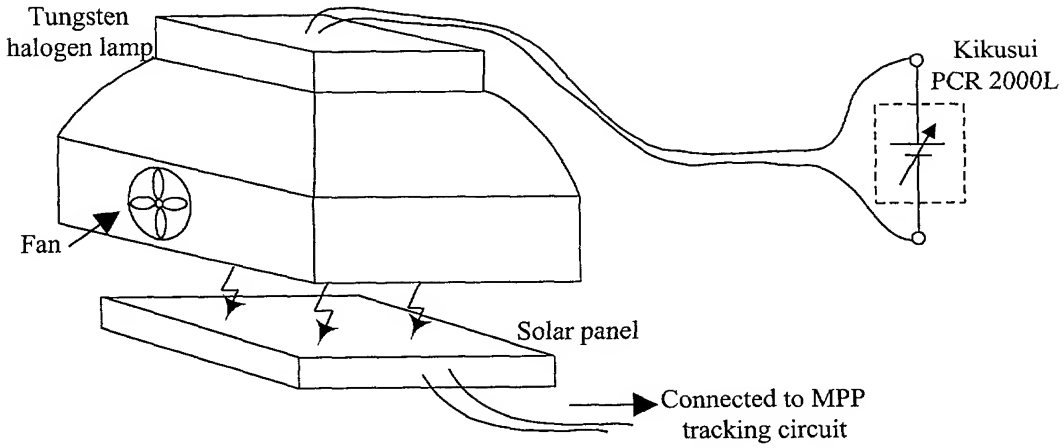


Fig. 16 Experimental setup for studying the proposed MPP tracking technique.

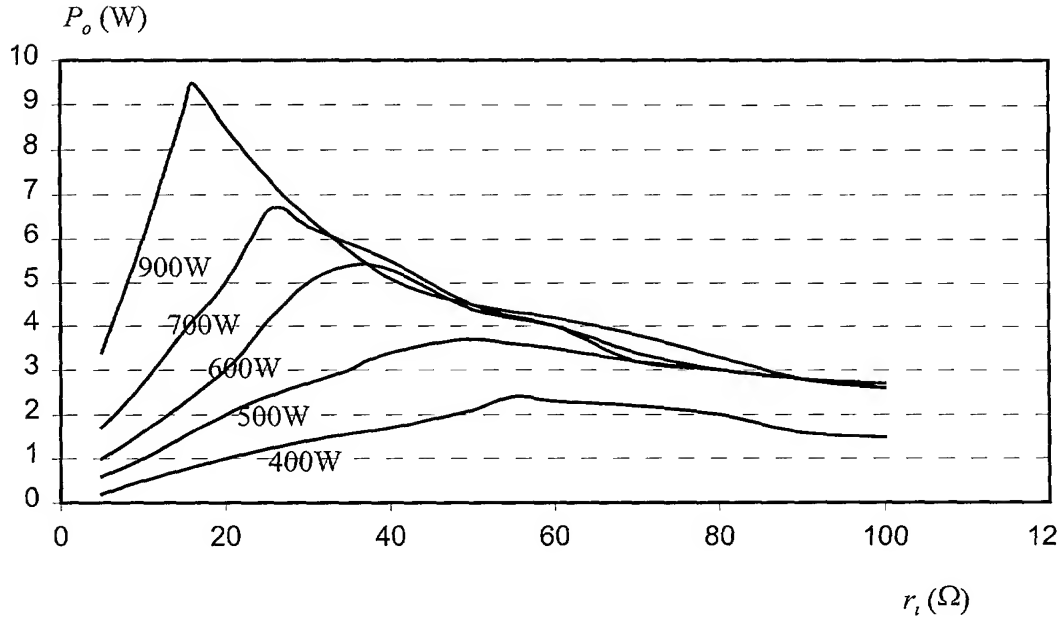
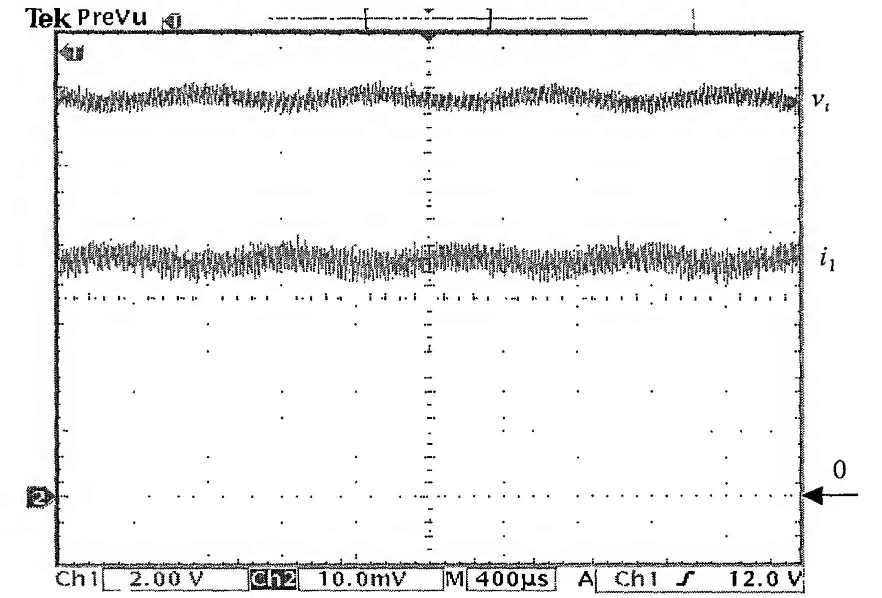
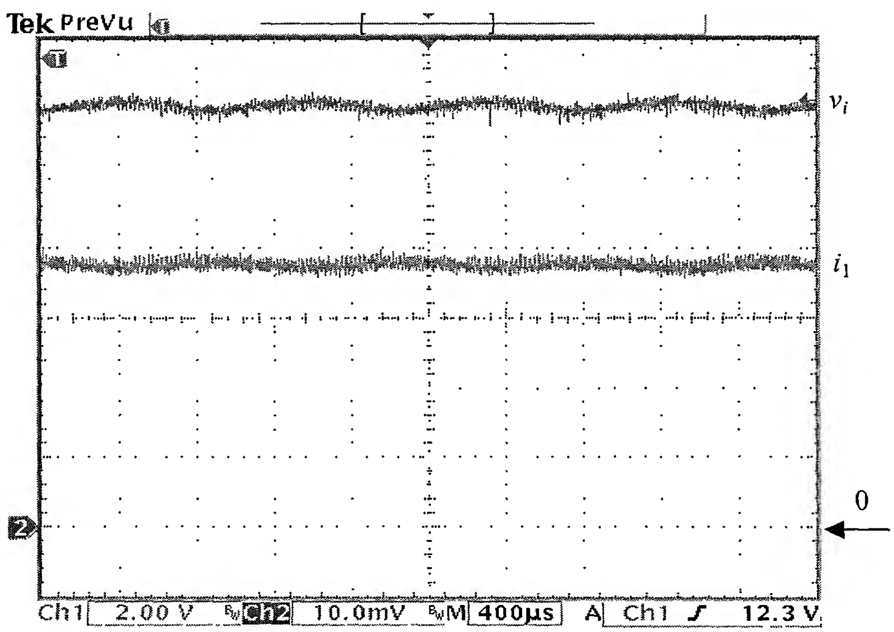


Fig. 17. $P_o - r_i$ characteristics of the solar panel at different P_{lamp}.

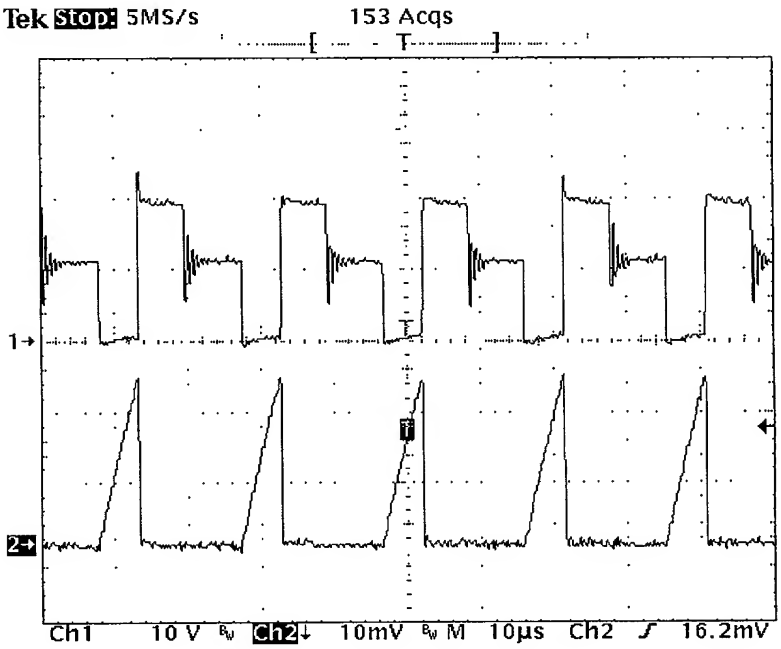


(a) DICM. (v_i: 2V/div. i_1: 0.2A/div.)

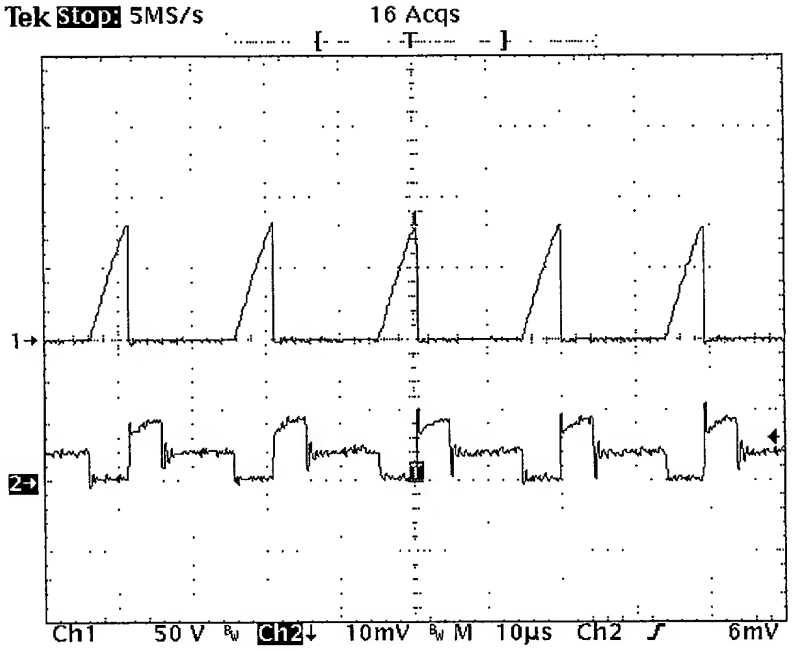


(b) DCVM. (v_i: 2V/div. i_1: 0.2A/div.)

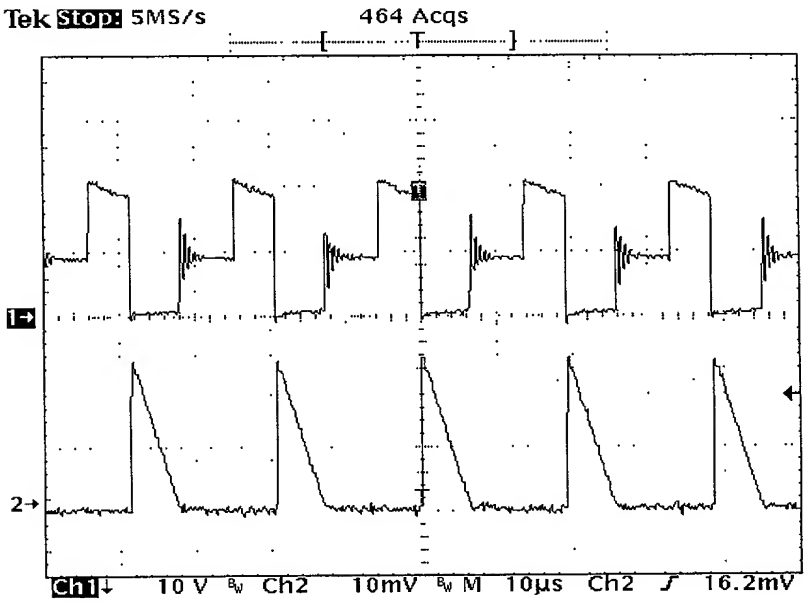
Fig.18. Experimental waveforms of v_i and i_1 of the two SEPIC prototypes at the MPP when P_{lamp} equals 900W.



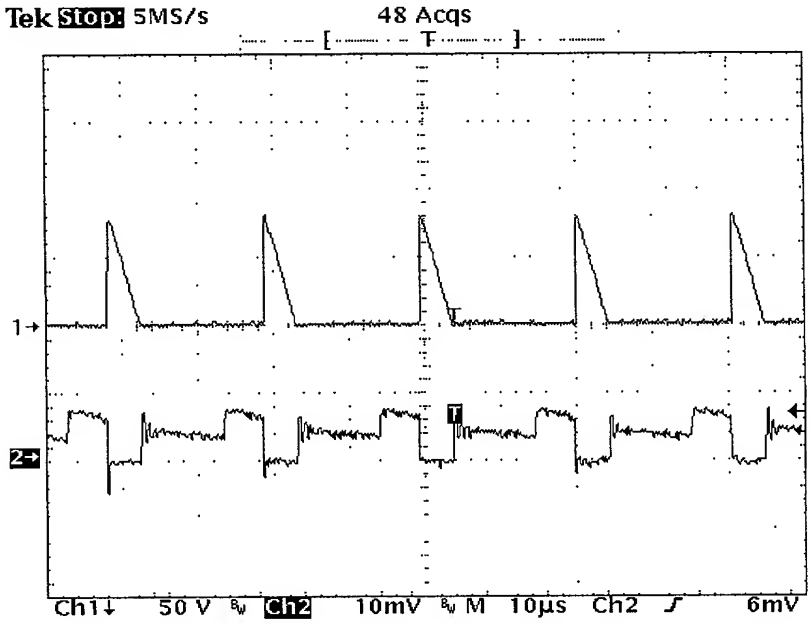
(a) Voltage and current stress on *S* in DICM. (Ch1: 10V/div. Ch2: 2A/div.)



(a) Voltage and current stress on *S* in DCVM. (Ch1: 50V/div. Ch2: 2A/div.)

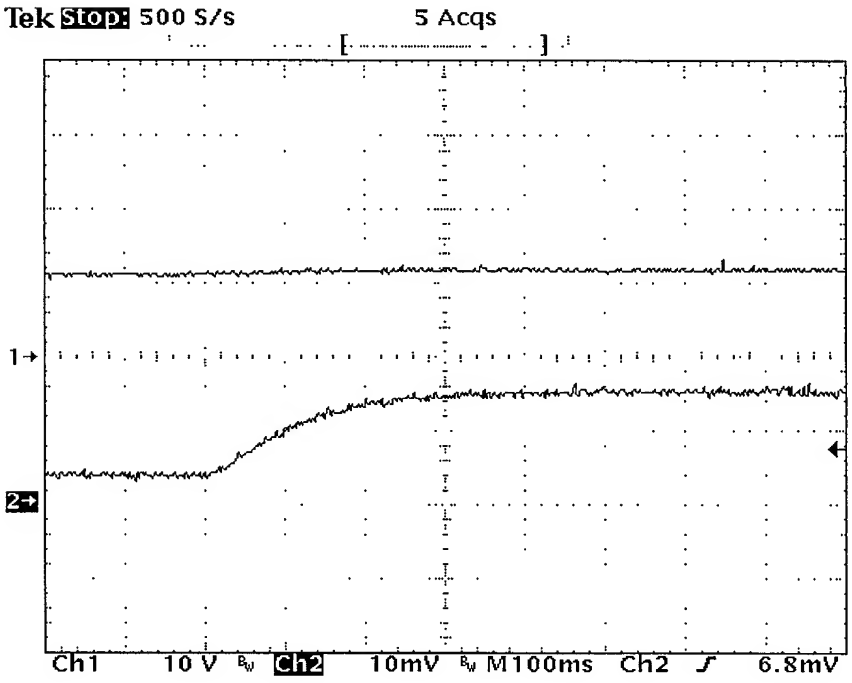


(c) Voltage and current stress on D in DICM. (Ch1: 10V/div. Ch2: 2A/div.)

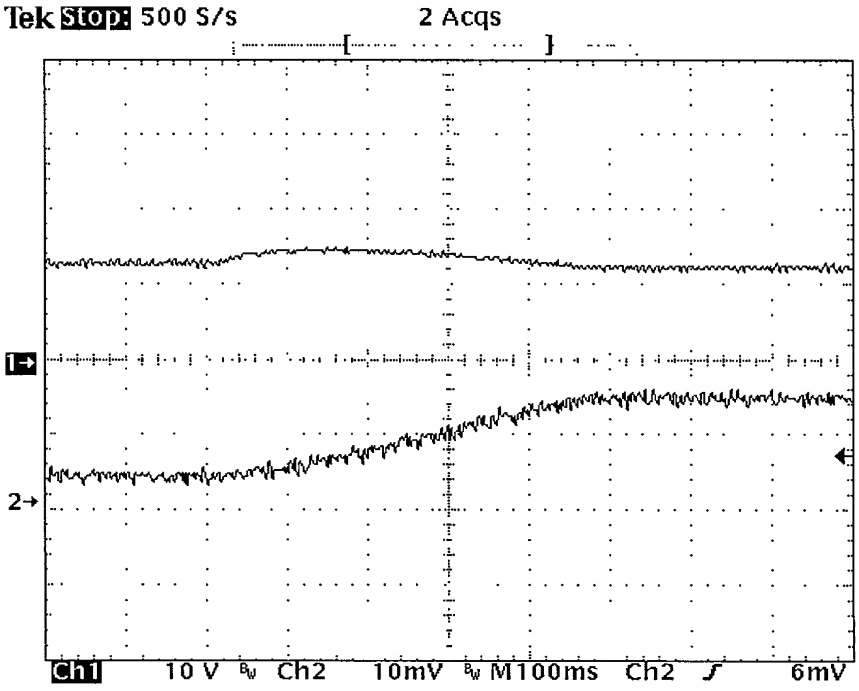


(d) Voltage and current stress on D in DCVM. (Ch1: 50V/div. Ch2: 2A/div.)

Fig.19. Experimental voltage and current stresses on S and D. (Timebase: 10µs/div)

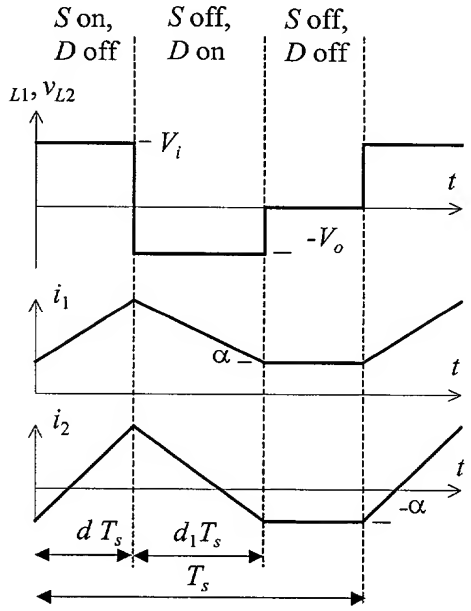


(a) DICM.

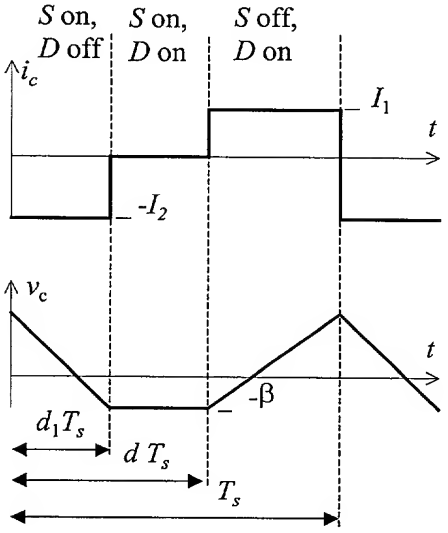


(b) DCVM.

Fig. 20. Experimental waveforms of the SEPIC converters when P_{lamp} is subject to a change from 400W to 900W. (Ch1: V_i, 10V/div. Ch2: I_1, 0.5A/div.)



(a) Voltage and current waveforms of L_1 and L_2 in DICM.



(b) Current and voltage waveforms of C in DCVM.

Fig. 21 Key waveforms of SEPIC and Cuk converter.